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ABSTRACT

Twentieth century science is producing a wonderland of paradoxes, a new scientific literature of subjective, imaginative writing, a validation of all creative expression in the arts, and interaction with the so-called subjective and pseudo sciences from psychiatry to the paranormal. Cartesian dualism and reductionistic thinking have formed the paradigm by which the university and educational curricula in general have been structured. Such thinking is inconsistent with discoveries made in mathematics and science in this century and in nature itself. Discoveries in the sciences, such as quantum physics, that brought about paradigm shifts will cause radical changes in the fundamental content, expression, curriculum and pedagogy of the academy. This essay calls for a new conceptual framework for education, and sketches a picture of what such a framework would be like. The paradigm for a holistic curriculum will be consistent with the principles of reality found in the new sciences. (DB)

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Einstein and "Jabberwocky":

Through the Quantum Looking Glass

Two hundred years ago in a fabled kingdom much like Oz, a handsome philosophical prince and a beautiful, cultured princess of the ancient sire of the House of Humanities were deposed and shackled by a warlord and his consort of the House of Comte. The usurpers did not believe in magic, but used machinery, trickery and mercenaries from their cousin houses of DesCartes and Newton to overpower the prince and princess. And they used trinkets and gadgetry to distract the subjects. The Comtian pair proclaimed themselves emperor and empress and promptly declared that they needed no clothes in order to rule such gullible people. The royal pair was forced to leave their palace, live in an humble cottage on a meager budget, and serve the warlords, who had moved into the castle with all of its treasures.

The pretenders then devised an ingenious plan to ensure their rule and prevent insurrection: the divide-and-conquer strategy. Specialties were invented. Thus it was that the once free kingdom became an impossible honeycomb of barriers that seemed to grow walls within walls, separating kith and kin.

Before twenty years had passed, the Elysian kingdom was transformed into a huge clocklike machine. The prince and princess, along with their subjects, after a brief but aborted revolution reasserting their magical and natural bliss, grew as pale and colorless as Dorothy's Kansas. The variegated gardens and quaint cottages were replaced by sooty industrialized towns and then by massive steel and concrete monoliths proclaiming the power of the usurpers, and the once happy people became dronelike.

Then suddenly it seemed, the houses of Comte, DesCartes and Newton were overthrown by their twentieth century grandsons and granddaughters. Enlightened ones from the houses of Math, Physics, Psychology and Biology discovered the magical scepters once wielded by the prince and princess and did interesting, even magical, things, which delighted the scientific progeny. But their magic remained virtually unknown to the people and the royal couple. So the children of the ruling usurpers took the shackles from the royal pair and even showed them how to use their magic scepters in a cooperative kingdom that could make it even more beautiful and productive than before through a magnificent wedding of the true House of Science and the true House of Arts. They even said, "Look, our father and mother have no clothes. See!" But, alas, it had heppened that some of the grandsons and granddaughters of the royal pair had acquired Comtian, Cartesian and Newtonian genes and continued to perpetuate the clocklike, mechanical kingdom, even into the humble cottage of the prince and princess, who by now had grown used to their shackles and blinders and could no longer see except in a linear fashion. And the usurpers gloried in their nakedness.

Moral: Old quantum realities are hard to break.

And some people do not believe in fairy tales.

In pursuit of a truth in this fable, let us consider first the academic paradigm shift taking place in the sciences since 1971, which encourage, even demand, a shift in education that encompasses an English paradigm shift. One truth is that much of what masquerades as science today belongs in the technical school. The philosophy of science has always belonged to the Humanities, but was stolen by Auguste Comte in the seventeenth century, when

he fostered the mechanistic, Cartesian academic specialties and substituted the reductionist question How? for the philosophical one Why? This has changed. Yet while fairy tales should have happy endings, it is too early to predict this one. Education and English lag behind math, physics, psychology, medicine, biology and even business in initiating paradigm shifts. Consider briefly the background.

Modern discoveries in mathematics and empirical research in high-energy physics and in other sciences are creating a fantasy content and expression of these once mechanistic sciences so that they resemble the content and expressions of the once imaginative arts. The implicity unity (the "interconnectedness of things") of the new sciences has shown no difference in kind between the holistic pluralism of the new sciences and that of the older arts. Physicist Werner Heisenberg, in his famous Uncertainty Principle, declared mathematically the impossibility of an objective science or researcher and opened a pandora box of paradoxes that caused even Einstein to doubt the validity of mathematical proof. The results of this discovery over the next century will be radical changes in the fundamental content, expression, curriculum and pedagogy of the academy. This change in the traditional concept of reality and consciousness has been issuing from the major universities in the free world, research centers and some well-established maverick professionals. Mathematicians and physicists include all of the major names and some independent ones.

Education and English yet express the reality constructs, curriculum and pedagogy of a dying classical age. Artists and thinkers outside traditional educational institutions have been expressing the new realities even before Einstein and many after: Ambrose Bierce and William Faulkner in their use of quantum time and G.M. Hopkins' use of "inscape," for example.

It is something of an embarrassment to some reductionist scientists that modern sciences are confirming what the arts have believed and expressed both East and West for centuries. This symbolic expression, Heisenberg's Uncertainty Principle, worked the magic: $\Delta x \cdot \Delta v \geqslant \frac{h}{2m}$. One cannot overestimate the impact of this mathematical Rosetta Stone; it overshadows by far the Copernican revolution when it was new. Many a reaction to the new discovery is a blank stare and stunned silence. The world has been turned inside out and rightside up, even as the academic juggernaut lumbers on its bureaucratic momentum, carrying the English discipline on its back.

Old quantum realities are hard to break.

The break with the old reality was so shocking that, early in this century, Erwin Schrödinger said of his mathematically sound conclusion of alternate realities: "I don't like it, and I'm sorry I ever had anything to do with it." In their search for an adequate expression of the indescribable worlds we now know exist in the macrocosm and microcosm, mathematicians, physicists and other scientific researchers are using the language of poetry, anecdote and metaphor. They often invent or remanufacture terms rather than use traditional ones. Many physicists now use ὄν and ὄντος, rather than electron, which is too close to the Greek atomists. In The Nature of the Physical World, Sir Arthur Eddington described the unknowable electron: "Eight slithy toves gyre and gimbal in the oxygen wabe; seven in nitrogen. . . if one of its toves escapes, oxygen will be masquerading in a garb properly belonging to nitrogen." This is not a facetious remark. Eddington pointed out more than fifty years ago that all of the fundamentals of physics could be translated into "Jabberwocky." A little-known irony is that Lewis Carroll was a mathematical writer.

Twentieth century science is producing a wonderland of paradoxes, a new

scientific literature of subjective, imaginative writing, a validation of all creative expressions in the arts, and interaction with the so-called subjective and pseudo sciences from psychiatry to the paranormal. Perhaps the greatest seeming absurdity is the aligning of the modern sciences with a new romanticism (Einstein, Heisenberg, Schrödinger, Bohr, et al.) in its triumph over a dying classicism (Newton, DesCartes, Comte, LaPlace et al.). A final anomaly is that thinking across the scientific curriculum is challenging Writing Across the Curriculum for currency and relevancy.

The essential unity of the universe received scientific proof early this century from some of science's major names. Werner Heisenberg's history and philosophy of quantum physics, called simply Physics and Philosophy, had an enormous impact on the direction of physics and all science this century. He was one of the founders of the quantum theory along with Einstein and Niels Bohr, and he shattered forever the earlier idea of the universe as a machine made of separate parts. He saw it as an indivisible whole with a network of relationships that include the so-called objective observer researcher.

One of the greatest ironies of the twentieth century is that, as reductionist biologists were trying to purge consciousness from neurological processes, physicists were publishing evidence of how mind is integral to our understanding of the universe, that the universe itself is mind. Erwin Schrödinger was at the forefront of this movement. His now famous cat experiment proves that the cat in the box (not in the hat) was both or neither dead nor alive until an observer (a mind) made one or the other option a reality. The mind creates reality in a universe of alternate realities. The also famous Copenhagen Interpretation in physics believes that both states exist

in a superstate, and the Many Worlds Hypothesis of Hugh Everett III is just as mind boggling, which believes both halves branch off into a parallel universe. In this, the favorite interpretation among physicists, every reaction between a quantum event and an observer splits the cosmos into a staggering number of parallel universes in which all states of the quantum are equally real.

The Writing Across the Curriculum movement, however, is symptomatic of a deeply-rooted problem, a result of our current reductionist system; it is Jacques Barzun's fragmented university in his The American University. Allan Bloom, in his The Closing of the American Mind, writes a scathing indictment of the modern American university and its transformation into "a trade school for the bewildered." How far have the new sciences moved beyond popular thinking in the academy? Consider:

1. The universe does not exist until a mind perceives it.
2. Mind and matter are no longer seen as separate, but matter is an extension of mind, which is everything.
3. By measuring photons from distant stars entering the gravitational field of a galaxy, a researcher changes them into either particles or waves, depending upon the measuring device used--or both at once. The researcher can also influence their bahavior at that time, even though the event took place billions of earth years ago.
4. The universe is not a vacuum, but an elaborate structure of turbulent and frothy subatomic storm of activity acting in patterns of predetermined purpose, not haphazardly.
5. The cosmos and all interconnected constituents have an implicit moral order and purpose in addition to and beyond physical survival.
6. Each quantum particle processes information in a unique way, for mind and consciousness are inherent in every electron.

7. The creation of biological life on earth by a purely random sequence of events, the Hundredth Monkey Syndrome, is so mathematically remote as to be impossible. A supermind must be behind the order and purpose in the cosmos.
8. The increasingly popular Anthropic Principle is reversing the Copernican banishment of mankind to a remote speck in the universe, a reductionist conclusion, to the view that mankind is both unique and special.
9. Consciousness is separate from the brain, although deeply intertwined with it.
10. In our holographic universe, time and space are no longer fundamentals; past, present and future all exist simultaneously.
11. The human race is fundamentally one organism, just as are all species, and nature itself is a living organism with all of the intelligence, moods, and capacity to heal itself, as are all of its parts, such as a species.

The listing could easily be continued.

Choice, free will, is crucial to the new realities. If our realities depend upon choice, it follows that a universe based upon choices requires the proper education for an evolving species in how to make choices and the proper choices to make for the individual, society, and the cosmos--an ethical decision. Language gives a clue to two sets of observables, scientific and ethical. Science uses the indicative mode, ethics the imperative. The latter is hardly acknowledged today. The interconnections of physics and ethics are easily illustrated. The phenomenal law of cause and effect and the curved space theory, in which an action returns to its sender, have their corollary in the ethics of every major theological system: Whatever a person sows, that he/she will reap; cast your bread upon the waters and it will

return; and the now popular Eastern version of Karma is better understood in the domain of physics.

The new conceptual framework for education will include biological, psychological, social and natural interrelationships in a dynamic balance. The framework will be built upon the insight that living, self-organizing systems not only have the tendency to maintain themselves in their state of dynamic balance, but also to transcend themselves, to go intuitively and creatively beyond their present limitations and generate new structures and new forms of organization with an entirely new state of balance. This balance will be seen to affect the entire system with positive benefits from good health and peace of mind to personal happiness, values missing in modern education goals.

Allan Bloom's solution to the mechanistic view is a return to the Great Books. John L. Casti, mathematician and physicist, in his Paradigms Lost, advocates a return to the Great Problems. These problems include the origin of life, quantum reality, sociobiology, and many other fundamental questions, particularly, Why? A paradigm for a holistic curriculum may parallel the holistic health movement in many ways. The paradigm will also be consistent with the principles of reality found in the new sciences. The new education will work symbiotically, as in nature, which reveals its cyclical patterna such as the gyres and spiral staircases of W.B. Yeats. From the human organism to the cosmos, all things are now viewed in a continuous flow and change revealing cyclical patterns which may be understood with study in the next century. The Chinese called this the Tai ch'i, fluctuations between the yin and yang. The dynamic balance is well known to both Eastern and Western literature as the Golden Mean.

Academic writing evolved from Cartesian mechanism and the need for standard expression. Its logic belongs to the classical DeCartes, Newton

and Aquinas. While structure is the major characteristic of academic writing, the sciences and other disciplines have explored a wider range of genres and their most natural characteristic--rhythm. Rhythm--fluctuations, oscillations, vibrations, waves, spirals--is important to all of the new paradigms, and so it is to the new English one. Order is found naturally in the distinctive rhythm. Rhythm is characteristic of everything: the universe, from subatomic waves to galactic spirals; the species, from the DNA double helix to economic theories; and the individual, from fingerprints to cells. In a newly discovered holonomic universe, a writer will be taught to include rhythm in a systems approach--from the individual, the society, the ecosystem to the cosmos.

A pedagogy for achieving these new purposes will cut across the old disciplines and integrate such variations of the same frequencies as music and visual arts, much as a progressive department store does with everyday mechandizing. Education and English will emphasize the organic, gentle, nonviolent, elegant and beautiful. "Usefulness" will receive a new, more comprehensive definition; "commonsense" has been traced to a Cartesian origin.

The new English pedagogy will have a deep personal involvement between teacher and student where the student receives maximum freedom for individual/social growth and personal responsibility for setting his/her own educational goals and outcomes. The new teacher will give the student his/her utmost devotion and guidance, helping each student to be responsible for developing his/her unique, total self. The teacher will provide the student with information for achieving an educational goal; the student will then picture the entire process in a technique called in psychology "guided visualization" in a way appropriate to the student, integrating his/her

own desires, expectations and hopes. Faithful to Heisenberg and the new realities, the teacher will place great emphasis on subjective knowledge and expression without feeling threatened by it. Poetry and the other arts will reassume their important role in the destiny of the individual and society and a standard requirement of the composition class.

The new English course will be Anthropic, somewhere between Copernican and Ptolomaic thinking, and subjective. Subjective expression will be expected, encouraged and rewarded, even in the sciences and business; holonomic reality, the presence of "all in each and each in all," will inform the total academic approach. This creative expression will be recorded carefully in something like a sophisticated journal; all other course appointments may well be satellites to the daily journal.

Poetic statement, widely used now in the new sciences, will be reinstated as a major genre and catalyst for other genres, rising from the purely personal to the cosmic. Pierre Teilhard de Chardin, Jesuit scientist, shows how evolution proceeds from simple to complex forms and purposes, a rise in consciousness culminating in "spiritual" forms and purposes. Chardin will be restudied for his prophetic insights.

The journal has already achieved near major importance in the writing course. My students do their best writing in their journals, their worst and least convincing in the formal class essay. In their journals, they write poetry, sometimes very good poetry. They write fiction. Sometimes they cannot stop writing it. And they write something like the now old "new journalism." A college business department head has discovered the freewriting journal as a tool for understanding and helping students and has replaced portions of his textbook with it.

Emotions will take their rightful place with critical thinking. How long has the university looked with suspicion upon emotions? From the time of the Greek academy, the emotions were considered feminine and thus a lesser faculty, and logic a singularly masculine characteristic, except for such prophetic figures as the Romantics. Also, the subjective over the centuries became doubtful vestiges of medieval mysticism, not useful at all in a reductionist society. The current movement of the university from the administrative age to the technological age with its attendent quantifications has misunderstood the nature of writing. Writing will be rightly seen as proceeding from a nonquantifiable domain.

Writing Across the Curriculum, therefore, has already been accomplished by the sciences, for scientists commonly give "scientific statement and opinion" in figurative language. Business has discovered freewriting, and at least one biology professor uses poetry in the class. Why not poetry in astrophysics and astronomy? After all, if the milky way cannot make a person wax poetic, what will? And why not historical fiction in the social sciences? Let the student become part of the Waterloo battle or one of the throngs welcoming Caesar from Gaul. Why not imaginative architecture? How many architects could learn something important to life from Kahlil Gibran?

> Then a mason came forth and said, Speak to us of Houses.
>
> And he answered and said:
>
> Build of your imaginings a bower in the wilderness ere you build a house within the city walls.
>
> For even as you have home-comings in your twilight, so has the wanderer in you, the ever distant and alone.
>
> Your house is your larger body.
>
> It grows in the sun and sleeps in the stillness of the night;

and it is not dreamless. Does not your house dream? and dreaming, leave the city for grove or hill-top?

Would that I could gather your houses into my hand, and like a sower scatter them in forest and meadow.

Would the valleys were your streets, and the green paths your alleys, that you might seek one another through vineyards, and come with the fragrance of the earth in your garments. . . but these things are not yet to be.

New quantum realities aren't hard to make.

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Definitions

Cartesian dualism The Renaissance viewpoint defined by DesCartes' formulation of its basic dualism and Comte's clarification of half of this dualism into specific sciences. It separated subjective and objective perceptions and and divided the objective into such specialties as physics, chemistry, biology, and sociology, leading to the present separation of educational specialties, an organization inconsistent with discoveries in mathematics and science this century and in nature itself.

Christian Aristotelianism The organization of knowledge of the medieval world by the Aquinas-Aristotle synthesis that put together Greek science and Christian theology in one coherent statement.

Consciousness and reality The older, and still popular, view of consciousness is that of something with defective senses trying to figure out the world. Today, it is seen in the sciences as the producer of reality by applying its own limited sense of organization on its own reality constructs.

Holonomy, holonomic reality The presence of "all in each and each in all," the whole being contained each of its parts.

Macrocosm Things too big or whizzing by too fast to be seen or touched, even theoretically.

Microcosm Things too small to be seen or touched, even theoretically.

Mind A self-organizing aspect of life. The essence of being alive. Different from, but intertwined with, the physical brain, but not separated from matter since all of the principles of organization in the universe are essentially mental.

Reality The sciences now use such terms as alternate or multiple realities. These percepts consider the impact of mind on (so-called) matter. Reality constructs, even from the same person, change from one domain, such as art, to another, such as science, and one natural level to another.

Reductionism The practice of attempting to account for all of the properties of highly complex systems in terms of their simplest components, part of our cultural thinking for centuries and only lately abandoned by science. From the Latin verb reducere "to pull back." Scientific reductionism dates back to earliest history, where everything, from things to ideas, were reduced to physical phenomena. The atomic theory is the oldest and simplest of all reductive attempts, both in the East and West. Reductionism has led to enormous traps and errors in science and philosophy and must be abandoned by all of society if further evolutionary progress is to be made.

Tai ch'i From Chinese medicine, energy, or vital energy, but not a substance nor a quantification. The various patterns of cyclical flow and fluctuation in the human organism, and the continual exchanges between organism and environment.

Yin/yang Chinese view that all natural phenomena are manifestations of continual oscillations between two poles and all transitions should take place gradually and in unbroken progression. The natural order is one of dynamic balance between yin and yang.

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